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14. ABSTRACT

Purpose: The purpose of this study was to determine if telehealth coaching is superior to one-time nutrition and fitness education regarding dietary and exercise contributions to bone health assessed before and after a 9-month deployment. **Design/Methods:** Prospective, longitudinal, cluster-randomized, controlled trial. Outcomes included anthropometrics, bone density, bone turnover, dietary intake, and frequency/ intensity of work, sport, and leisure activities. All soldiers received one-time nutrition and fitness education prior to deployment; Telehealth Group received health-related messages via internet mail platforms while deployed. **Sample:** 234 male and female Soldiers, aged 18-30, were recruited/enrolled from deploying combat arms units; Telehealth Group (TG) n=85, Control Group (CG) n=149. **Analysis:** A linear mixed model approach was used to analyze the data longitudinally in SAS v9.2, as well as the MICE package in R v3.0.1. **Findings:** Internet transmission of materials and soldier access to them limited intervention dose. There were no significant differences between groups upon return, except an increase in body fat (BF) (p=.003) and sport activities (p=.015) for the TG. Higher BF is an unexpected finding since there were no differences in calories consumed, weight, or work and leisure activities between groups. Consumption of vitamin D increased in both groups. **Implications for Nursing:** Choices regarding lifestyle are important for all young adults but the obstacles to a balanced diet and exercise regimen in the deployed environment may have longstanding consequences for the soldier, and a fit-and-ready force. Early and aggressive educational efforts can help prevent chronic musculoskeletal conditions but require innovative approaches.

15. SUBJECT TERMS

chronic musculoskeletal conditions, bone health, telehealth coaching, nutrition and fitness education

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Abstract

Title: A Coaching Intervention to Promote Nutrition and Bone Health in Deployed Soldiers

Purpose: Soldiers are redeploying with significant musculoskeletal injuries from occupational demands and unhealthy weight from alterations in diet and exercise behaviors. Inadequate consumption of calcium and vitamin D and decreased exercise while deployed can be detrimental to bone health. The purpose of this study was to determine if telehealth coaching is superior to one-time nutrition and fitness education regarding dietary and exercise contributions to bone health assessed before and after a 9-month deployment.

Design/Methods: Prospective, longitudinal, cluster-randomized, controlled trial. Outcomes included anthropometrics, bone density, bone turnover, dietary intake, and frequency/ intensity of work, sport, and leisure activities. All soldiers received one-time nutrition and fitness education prior to deployment; Telehealth Group received health-related messages via internet mail platforms while deployed.

Sample: 234 male and female Soldiers, aged 18-30, were recruited/enrolled from deploying combat arms units; Telehealth Group (TG) n=85, Control Group (CG) n=149.

Analysis: A linear mixed model approach was used to analyze the data longitudinally in SAS v9.2, as well as the MICE package in R v3.0.1.

Findings: Internet transmission of materials and soldier access to them limited intervention dose. There were no significant differences between groups upon return, except an increase in body fat (BF) ($p=.003$) and sport activities ($p=.015$) for the TG. Higher BF is an unexpected finding since there were no differences in calories consumed, weight, or work and leisure activities between groups. Consumption of vitamin D increased in both groups.

Implications for Nursing: Choices regarding lifestyle are important for all young adults but the obstacles to a balanced diet and exercise regimen in the deployed environment may have longstanding consequences for the soldier, and a fit-and-ready force. Early and aggressive educational efforts can help prevent chronic musculoskeletal conditions but require innovative approaches.

TSNRP Research Priorities that Study or Project Addresses

Primary Priority

Force Health Protection:	☒ Fit and ready force ☐ Deploy with and care for the warrior ☐ Care for all entrusted to our care
Nursing Competencies and Practice:	☐ Patient outcomes ☐ Quality and safety ☐ Translate research into practice/evidence-based practice ☐ Clinical excellence ☐ Knowledge management ☐ Education and training
Leadership, Ethics, and Mentoring:	☐ Health policy ☐ Recruitment and retention ☐ Preparing tomorrow's leaders ☐ Care of the caregiver
	☐

Secondary Priority

Force Health Protection:	☐ Fit and ready force ☐ Deploy with and care for the warrior ☐ Care for all entrusted to our care
Nursing Competencies and Practice:	☒ Patient outcomes ☐ Quality and safety ☐ Translate research into practice/evidence-based practice ☐ Clinical excellence ☐ Knowledge management ☐ Education and training
Leadership, Ethics, and Mentoring:	☒ Health policy ☐ Recruitment and retention ☐ Preparing tomorrow's leaders ☐ Care of the caregiver
Other:	☐

Progress Towards Achievement of Specific Aims of the Study or Project

The Army leadership strives to ensure the continuous safety, health, and performance of Soldiers in combat. To this end, proper nutrition and physical fitness remain priorities of force health protection during deployments at all levels of Command. Conditions of deployment such as heavy body armor, environmental extremes, and changes to diet and exercise habits, coupled with dehydration, fatigue, and psychological stress can lead to deterioration in the physical and mental health of young Warfighters who are expected to be at peak performance during combat. These Warfighters are predominantly enlisted soldiers who comprise 82% of the total Army force, with 69% of them between 17 and 30 years of age today.[1] This age range coincides with the period of peak bone mass, when the growth in the size of bones and the accumulation of bone mineral has stabilized. Genetic factors account for 60% to 80% of variance in peak bone mass and bone size[2] with the remainder influenced by hormonal status, diet, environmental factors, and exercise. The most important modifiable risk factors associated with bone density include hormonal status, physical activity, and nutrition. [3,4] Education about weight-bearing exercise and proper food choices containing calcium and vitamin D may promote strong bones, minimize stress fracture risk, and reduce musculoskeletal injuries leading to improved overall health and military readiness. The purpose of this study was to determine if telehealth coaching was superior to one-time diet and exercise education to promote nutrition status and bone health during deployment for active duty soldiers.

A total of 234 male and female soldiers from combat arms units on Joint Base Lewis-McChord volunteered to participate in this prospective, longitudinal, cluster-randomized, controlled trial. The Control Group (CG), comprised of 149 soldiers who deployed for 12 months, returned first; 92 were available for post-deployment measurements. In the Telehealth Group (TG), 64 of the initial 85 soldiers were available for measurements upon redeployment. All soldiers received one-time nutrition and fitness education prior to deployment; the TG received online, on-demand health coaching to promote sound nutrition and bone health throughout a 9-month deployment. The use of separate units was purposeful to avoid concerns about treatment contamination. The overall attrition rate was 33%. This is typical for deployment-related soldier studies; the return rate of 67% was considerably higher than most reports.[5] Reasons for the attrition include reassignment to a new unit, discharge from the Army, injuries sustained during deployment with early return, or the soldier could not be located in a timely manner. To assess the telehealth intervention on nutrition and bone health, anthropometric data, dietary intake, and exercise activities were obtained pre-deployment and again within 30 days of redeployment for both cohorts of soldiers. The analysis plan excluded data for the 14 female participants because only one returned for post-deployment comparison measurements. Continuous variables (dietary intake, body composition, and physical activity changes) from pre- to post-deployment were analyzed using paired t-tests to identify changes that occurred during deployment. For categorical variables, the tests of difference in change over time were computed using generalized linear mixed models. The Multivariate Imputation by Chained Equations (MICE) with classification and regression trees was used as the underlying modeling technique. Final analyses were conducted using the MICE package in the statistical software R v3.0.1 (R Foundation for Statistical Computing, 2013). Statistical significance was set at the $p \leq .05$ level.

Specific Aims and Research Questions were as follows:

1. The ***primary aim*** of this study was to determine if a telehealth coaching initiative is superior to one-time general nutrition and fitness education to promote nutrition and bone health.

2. The ***secondary aim*** was to determine if a telehealth coaching intervention accessed throughout the deployment period is superior to one-time general nutrition and fitness education provided prior to deployment regarding:

   a) dietary contributions to bone health as measured by the intake of calcium and vitamin D from food, beverages, dietary supplements, and medications, and
   b) exercise contributions to bone health as measured by biomarkers of bone formation/resorption/turnover and heel bone mass.

Research questions addressed by this study include:
1) Is on-demand telehealth coaching an effective strategy to reach young soldiers during deployment to assist them with maintaining a healthy diet and exercise routine?
2) Does on-demand telehealth coaching during deployment assist soldiers in the telehealth group (TG) to maintain bone mass more effectively than soldiers in the control group (CG) who receive one-time only general nutrition and fitness education?
3) Is there a difference in exercise habits between soldiers in the TG receiving telehealth coaching while deployed and the CG receiving only general nutrition and fitness education pre-deployment?
4) What is the usual calcium and vitamin D intake in the diet of soldiers and how is this impacted by deployment conditions?
5) Is there a difference in calcium and vitamin D intake between soldiers in the TG receiving telehealth coaching while deployed and the CG receiving only general nutrition and fitness education pre-deployment?

1. The *primary aim* of this study was to determine if a telehealth coaching initiative is superior to general nutrition and fitness education to promote nutrition and bone health.

Progress: The telehealth coaching intervention was created as an online mode of communication to assist soldiers in the TG with access to just-in-time information. The initial website was established in the Army Knowledge Online (AKO) web portal. An alternate method established was the Army Outlook email platform, which allowed secure, direct communication between participants and coaches. Access to the websites was password-protected and only soldiers in the TG were provided with a password. Posted materials and email correspondence was tailored to study aims; emphasis was on calcium and vitamin D intake from food/supplement sources, as well as bone-building exercise tips and techniques. Examples of online postings include material discussing hydration, healthy serving sizes of fruits and vegetables, how to get calcium and vitamin D into the diet, appropriate exposure to sun, exercise routines, and limiting soda, caffeine, and tobacco use. Alcohol was prohibited in theater so this was not a concern. Content experts in bone health reviewed the content of the site for accuracy and appropriateness while nurses with previous experience in using web-based health education reviewed the site for usefulness and ease of navigation. Measures of the "dose" of the intervention included number of log-ins, number of email exchanges (sent/responded), web viewing time, and tip sheets

viewed/downloaded. Team members referred the participant to links on the study website to fully address each question or concern. We retained the server log to validate the number of times an individual may have logged on to the site and whether or not other individuals gained access without permission.

Pre- to post-deployment changes within groups and between groups in anthropometrics and bone density are shown in Table 1. After a False Discovery Rate (FDR) correction was applied for multiple testing, ***only change in body fat was significant within and between groups from baseline to follow up.***[6]

Table 1. Pre- to Post-deployment Changes in Anthropometrics*

	Pre-deployment (Baseline)		**Post-deployment (Follow Up)**		**Change: Follow Up-Baseline**		**Diff**	**FDR**
Variable	**CG (n = 135)**	**TG (n = 85)**	**CG (n = 135)**	**TG (n = 85)**	**CG (n = 135)**	**TG (n = 85)**	***p***	***p***
Height (in)	69.4 (0.23)	69.1 (0.3)	–	–	–	–	–	–
Weight (lbs)	188.2 (2.61)	180.9 (3.51)	185.1 (2.58)	181.1 (3.24)	−3.03 (1.19)	0.16 (1.46)	0.09	0.23
Waist circ (in)	34.3 (0.31)	33.7 (0.38)	33.8 (0.27)	33.8 (0.34)	−0.53 (0.19)	0.11 (0.24)	0.04	0.21
Body fat	19.1 (0.5)	17.4 (0.62)	18.6 (0.51)	21.4 (0.67)	−0.52 (0.42)	3.94 (0.56)	<0.0001	**0.003**
BMI	27.4 (0.33)	26.5 (0.41)	27.0 (0.34)	26.6 (0.42)	−0.41 (0.17)	0.06 (0.21)	0.08	0.23
RMR (kcals/d)	2071.4 (33.53)	2016 (41.43)	1912.32 (39.8)	1954.76 (46.4)	−159.05 (45.9)	−61.24 (53.9)	0.18	0.28
BMD (gms)	0.59 (0.01)	0.62 (0.01)	0.65 (0.01)	0.64 (0.02)	0.06 (0.01)	0.02 (0.01)	0.01	0.09

*Mean (SE) reported. "–" indicates no further height measurements taken

Female soldiers are not represented in the overall data analysis; all 14 females enrolled were in the CG and only 1 of 14 returned, limiting any opportunity for comparisons across gender. At baseline, the female cohort was comparable to the male cohort with no remarkable differences; average age was 21.9 (1.9) years, and ethnicity/race representation revealed White 57%, Black 28.6%, Hispanic 7%, and Asian 7%. The majority, 8 of 14, reported no tobacco use with the remaining 6 reporting cigarette smoking of 1/2 ppd. Similarly, the majority (9/14) of females reported no alcohol use, yet 2 females admitted to consuming up to 10 drinks per week. One female indicated a history of stress fracture. The baseline anthropometric measurements of females enrolled are shown in Table 2.

Table 2. Baseline Anthropometrics CG– Females only

	N	Mean	SD
Age	14	21.7	1.9
Height (in)	14	64.3	2.43

Weight (lbs)	14	143.1	23.9
Waist circ	14	29.7	4.1
Body fat	14	27.8	6.3
BMI	14	24.3	4.2
RMR (kcals/d)	14	1620.43	246.02
BMD	14	.652	.15

2. The *secondary aim* is to determine if a telehealth coaching intervention accessed throughout the deployment period is superior to one-time general nutrition and fitness education provided prior to deployment regarding:

a) dietary contributions to bone health as measured by the intake of calcium and vitamin D from food, beverages, dietary supplements, and medications, and
b) exercise contributions to bone health as measured by biomarkers of bone formation/resorption/turnover and heel bone mass.

Progress (Dietary contributions to bone health): a) Dietary intake during the deployment year was obtained using the Block Food Frequency Questionnaire (2005.1).[7] This questionnaire estimates usual and customary intake of a wide array of nutrients and food groups (about 110 food items), takes 30–40 minutes to complete, and is intended for self-administration. This tool was selected because it has been widely tested and used in young adult populations. [8] The food list for this questionnaire was developed from the NHANES 1999–2002 dietary recall data. We purchased questionnaires from NutritionQuest (Berkeley, CA, USA) and returned them for processing which included scanning, nutrient analysis, and computer editing. Results of the nutrient analysis, with the breakdown of all dietary components to include % carbohydrate, % fat, % protein, vitamins, minerals, and supplements consumed, were returned on a diskette along with original completed questionnaires. A sample of the individual analysis report is included in Appendix A.

Dietary intake during the time of deployment was remarkably similar for both the CG and the TG as shown in Table 3. At baseline there were insignificant differences; the changes from over the course of the deployment for both groups were negligible with no statistically significant differences in calories, micronutrients, macronutrients, calcium, vitamin D, phosphorus, vitamin C, vitamin K, or supplemental vitamins of any kind. This may well be a reflection of the foods that were available in the dining facility during deployment, which is the main, and often the only, dining option. We did not capture data specific to the dining facility menu at the various locations. Anecdotally, soldiers often reported a distaste for the milk in the dining facility and therefore many seldom drank this excellent source of calcium, vitamin D, and protein. Early in the war effort, fast food trucks and establishments were allowed to exist and serve soldiers when off duty. Over time soldiers struggled to meet Army fitness standards, partly due to weight gain during deployment, so most of the fast food operations were closed or made off-limits by the ranking Commander of U.S. and International Forces in Afghanistan, then Gen. Stanley McChrystal.

Calcium and vitamin D intake were measured via dietary questionnaire and blood levels were obtained prior to and post-deployment. The TG had a larger percentage of soldiers with vitamin D insufficiency and deficiency (blood tests) requiring supplementation prior to deployment compared with the CG. Levels remained low upon return; vitamin D deficiency

affected 20% of the control group. We had no reliable method to capture data on whether or not the individual filled their prescription prior to deployment or if they completed the prescribed treatment course. A review of records in AHLTA showed only 3 individuals filled their prescription, but it is unknown if they may have purchased their own supplement containing vitamin D. Levels in both the TG and the CG did increase so one assumption would be that an effort was made to consume more vitamin D. Increased exposure to the sun may also have contributed to higher levels of vitamin D. Amount of sun exposure was not recorded.

We selected eleven nutrients (protein, fat, carbohydrate, calcium, sodium, vitamin C, D, and K, potassium, phosphorus, and cholesterol) important to overall health and bone health in particular, along with energy intake (calories), to analyze. We calculated all nutrients as the sum of daily intake from food. Furthermore, supplemental intakes of vitamin C, vitamin D, and calcium were analyzed. Energy intake was compared to the U.S. Department of Agriculture's Dietary Guidelines for Americans estimated energy intake for males and females 18-25 years of age with moderate physical activity levels.[9] All other nutrients were compared to the Institute of Medicine's (IOM) dietary reference intakes (DRIs) for the 19-30 year life stage group; either as the Recommended Dietary Allowances (RDA) or the Adequate Intakes (AI). According to the IOM, the RDA is the average daily dietary intake level sufficient to meet the nutrient requirements of nearly all (97-98 percent) healthy individuals in a group calculated from an Estimated Average Requirement (EAR). See Table 4.

Table 3. Dietary Intake Pre- and Post-Deployment

Variable	**Baseline**		**Follow Up**		**FDR p**
	Control (CG)	Telehealth Group (TG)	Control (CG)	Telehealth Group (TG)	
Calories	2593.48 (112.61)	2773.89 (161.11)	2661.21 (112.95)	2537.55 (142.78)	0.249
Protein (g)	101.94 (5.04)	108.59 (6.83)	107.71 (5.14)	101.82 (6.6)	0.281
Fat (g)	102.95 (5.15)	110.81 (7.27)	106.37 (4.96)	101.58 (6.43)	0.252
Carbohydrate (g)	316.83 (16.51)	332.45 (22.06)	326.35 (18.37)	288.97 (22.06)	0.231
Calcium	1111.11 (54.82)	1130.03 (70.61)	1142.82 (53.91)	1068.52 (65.07)	0.449
Phosphate	1670.45 (82.18)	1771.25(117.54)	1817.6 (94.28)	1643.65(115.42)	0.231
Sodium	4227.83 (214.09)	4442.03 (285.74)	4551.85 (211.51)	4199.16 (273.95)	0.247
Potassium	3046.29 (147.75)	3240.57 (185.69)	3221.84 (135.19)	3025.75 (168.86)	0.247
Vit C	147.41 (8.68)	166.25 (22.46)	169.3 (10.37)	141.89 (12.41)	0.213
Vit D	191.15 (11.75)	184.62 (12.88)	211.56 (14.61)	205.49 (17.03)	0.985
Vit K	137.71 (9.02)	146.64 (12.07)	176.16 (11.91)	154.3 (15.23)	0.269
Vit C (suppl)	66.88 (19.87)	35.21 (8.34)	75.16 (26.7)	79.2 (33.8)	0.449
Vit D (suppl)	69.42 (11.79)	65.55 (12.29)	116.49 (17.63)	123.53 (24.71)	0.779
Calcium (suppl)	86.6 (18.56)	98.35 (22.86)	107.97 (21.4)	114.53 (29.25)	0.953

* All electrolytes and vitamins in mg

Table 4. Dietary Intake Compared to IOM Dietary Reference Intakes (DRIs)[a]

Nutrient	Baseline		DRI RDA[1] or AI[2]	% DRI[3]		Post-deployment		DRI RDA[1] or AI[2]	% DRI[3]	
	CG n=135	TG n=85		CG	TG	CG n=135	TG n=85		CG	TG
Calories kcal	2593.48 (112.61)	2773.89 (161.11)	2800	93	99	2661.21 (112.95)	2537.55 (142.78)	2800	95	91
Protein g	101.94 (5.04)	108.59 (6.83)	56	182	194	107.71 (5.14)	101.82 (6.6)	56	192	182
Fat g	102.95 (5.15)	110.81 (7.27)	108	95	103	106.37 (4.96)	101.58 (6.43)	108	99	94
Carbohydrates g	316.83 (16.51)	332.45 (22.06)	130	244	256	326.35 (18.37)	288.97 (22.06)	130	251	222
Calcium mg	1111.11 (54.82)	1130.03 (70.61)	1000[1]	111	113	1142.82 (53.91)	1068.52 (65.07)	1000[1]	115	107
Phosphorus mg	1670.45 (82.18)	1771.25 (117.54)	700[1]	239	253	1817.6 (94.28)	1643.65 (115.42)	700[1]	260	235
Sodium mg	4227.83 (214.09)	4442.03 (285.74)	1500[2]	282	296	4551.85 (211.51)	4199.16 (273.95)	1500[2]	303	280
Potassium mg	3046.29 (147.75)	3240.57 (185.69)	4700[2]	65	69	3221.84 (135.19)	3025.75 (168.86)	4700[2]	69	64
Vit C mg	147.41 (8.68)	166.25 (22.46)	90[1]	164	185	169.3 (10.37)	141.89 (12.41)	90[1]	188	158
Vit D IU[4]	191.15 (11.75)	184.62 (12.88)	600[1]	32	31	211.56 (14.61)	205.49 (17.03)	600[1]	35	34
Vit K mcg/day	137.71 (9.02)	146.64 (12.07)	120[2]	115	122	176.16 (11.91)	154.3 (15.23)	120[2]	147	129

[a]Avg age 23.7y; used 19-30 year life stage group.
1 Energy for moderately active males aged 18-25 derived from US Dept of Agriculture
2 Represents 35% of total energy based on the Acceptable Macronutrient Distribution Range (20-35%)
3 Dietary Reference Intake (DRI)
4 Vitamin D: 15 ug/day = 600 IU

As evident in Table 4, neither the TG nor the CG met greater than 35% of the IOM recommendations for intake of vitamin D. Intakes of potassium were also low at less than 70% of the DRI and this nutrient is also important for physiologic bone building activities. High phosphorus and sodium intake may reflect frequent consumption of carbonated beverages, which are high in these nutrients.

Progress (Exercise contributions to bone health): b) We obtained physical activity data using the Baecke Habitual Physical Activity Questionnaire (BHPAQ), a self-report measure of participation in routine physical activity.[10] The BHPAQ was chosen for this study because it is brief, easy to complete, and evidence for its validity and reliability have been described in a variety of populations of young adults.[11-13] The tool consists of 16 items that assess physical activity in three areas: work, sports, and leisure time. The BHPAQ allows for computation of a total activity score and individual work, sport, and leisure scores, with mean scores representing indices of physical activity in each of these areas.

Soldiers in the TG reported greater frequency, intensity, and proportion of time spent on sport activity during deployment than the CG, resulting in a significantly higher score on the sport index

of the BHPAQ (p = 0.02). (See Table 5.) More soldiers in the TG also reported active participation in a second sport than the CG, although this was not statistically significant. This gives some indication that the telehealth communications may have been effective in encouraging TG soldiers to engage in weight-bearing, muscle-strengthening exercises. The most frequently reported sports included soccer, weightlifting, basketball, and running; all endorsed by the American Osteoporosis Foundation to build and maintain bone density.[14] The presence and availability of a gym or any type of exercise facility is dependent on the deployment location; the more mature bases are more likely to have gyms with a wide variety of exercise equipment and structured classes.

Table 5. Physical Activity Scores Pre- and Post-Deployment

Variable	Baseline		Follow-up		Change: Follow-up to Baseline		FDR *p*
	CG n=135	TG n=85	CG n=135	TG n=85	CG	TG	
Work Index	3.14 (0.03)	3.35 (0.05)	3.14 (0.03)	3.32 (0.04)	0(0.04)	-0.04 (0.05)	0.71
Sports Index	2.94 (0.05)	2.68 (0.09)	2.76 (0.07)	2.97 (0.09)	-0.17 (0.09)	0.29 (0.11)	**0.02**
Sports Index 2	2.73 (0.05)	2.48 (0.08)	2.59 (0.07)	2.74 (0.09)	-0.14 (0.09)	0.26 (0.12)	0.07
Leisure Index	3.28 (0.06)	3.14 (0.08)	3.24 (0.09)	3.37 (0.11)	-0.05 (0.11)	0.23 (0.13)	0.25

Significance set at p < .05

Serum biomarkers of bone health were drawn at baseline and follow-up; markers included calcium, 25-hydroxyvitamin [25(OH)] vitamin D, osteocalcin, insulin-like growth factor (IGF)-1, bone-specific alkaline phosphatase (BS alk phos), and thyroid stimulating hormone (TSH). Phlebotomy was performed by trained Army medics or nurses on site where all measurements were taken in order to ensure blood tests were processed in a timely manner. Specimens were placed in a cooler and transported to the hospital laboratory for processing every 2 hours. Very few specimens were lost to hemolysis or insufficient quantity of blood. Select bone turnover markers are reported in Table 6. Of note is the significant change in osteocalcin across groups and across time. Osteocalcin is often referred to as a bone turnover marker because it is a secretory product of the osteoblast and is important in the bone matrix as a noncollagenous protein, and as part of the bone matrix it is released during bone resorption, reflecting the cycle of turnover. It is plausible that the greater frequency and intensity of sport activity reported by the TG explains this higher level of bone turnover. Of interest is the fact that the CG demonstrated greater BMD over the course of the deployment yet work, sport, and leisure activity did not increase, and the small increases in dietary intake of protein, calcium, and vitamin D seem unlikely to impact BMD. We asked soldiers about developing stress fractures during the 9–12 months of deployment; there were 15 new stress fractures reported during the post-deployment data collection; eight in the CG and seven in the TG. This is half as many as baseline figures for the CG but about the same for the TG. It is possible that the higher levels of osteocalcin represent healing stress fractures in the TG. There is no way of knowing if participants who were lost to attrition suffered stress fractures or other musculoskeletal conditions requiring a premature return from deployment. Baseline 25(OH) vitamin D revealed a high rate of insufficiency (61%, level < 30 ng/mL) and moderate level of deficiency (17%, level < 20 ng/mL) in the total sample. Participants substantially improved their 25(OH) vitamin D levels post-deployment but only the CG had a mean value above the recommended level of 30 ng/mL.[15]

Table 6. Bone Turnover Markers Pre- and Post-Deployment

Variable	Baseline Mean (SE)		Follow Up Mean (SE)		Change: Follow Up-Baseline		p	FDR p
	CG (n=135)	TG (n=85)	CG (n=135)	TG (n=85)	CG (n=135)	TG (n=85)		
IGF-1	189.1 (5.25)	205.24 (6.72)	178.74 (4.74)	184.18 (6.17)	−10.36 (5.38)	−21.06 (6.89)	0.21	0.31
25(OH) Vitamin D	27.75 (0.7)	21.65 (0.86)*	34.35 (0.94)	26.02 (1.11)*	6.6 (0.82)	4.37 (0.91)	0.06	0.23
Calcium	9.59 (0.03)	9.58 (0.04)	9.45 (0.03)	9.44 (0.04)	−0.15 (0.03)	−0.14 (0.04)	0.93	0.96
BS Alk phos	15.09 (0.53)	18.73 (0.67)*	17.12 (0.72)	20.22 (0.86)*	2.02 (0.59)	1.49 (0.7)	0.56	0.67
TSH	1.66 (0.08)	1.69 (0.1)	1.88 (0.17)	1.54 (0.18)	0.21 (0.16)	−0.15 (0.16)	0.09	0.23
Osteocalcin	18.48 (0.62)	21.12 (0.77)*	22.05 (0.99)	28.31 (1.08)*	3.57 (0.77)	7.18 (0.78)*	0.001	**0.01**

* Denotes significance between groups at baseline, at follow up, or across time; p < 0.05

Relationship of current findings to previous findings: This study indicates that diet and exercise coaching via telehealth methods to deployed soldiers is feasible, but limited in its effectiveness for short-term overseas deployments. Our results do not show favorable changes in body composition or significant changes in BMD, RMR, or dietary/ supplemental macro- or micronutrient intake in the Telehealth Group. Percent body fat increased from 17.44% to 21.28 % in the TG while percent body fat decreased from 19.09% to 18.56% in the CG. Our study is in agreement with other studies showing a significant increase in body fat in redeployed soldiers.[16,17] These previous studies also reported a decrease in aerobic exercise during deployment, which might explain the increased body fat. Similarly, studies in athletes have reported increases in body fat when aerobic training from running is reduced or stopped.[18,19] Our study did not measure aerobic fitness; however, there was a significant positive change in sport activity in the TG, which was not evident in the CG, both for one sport and two sport activities, leaving few explanations for the increased body fat. Studies of deployed soldiers show the need to increase aerobic training and improve aerobic fitness with the specific aim of optimizing health and mission performance.[18,19] The increase in percent body fat was not explained by increases in caloric intake, as there were no significant changes in mean calories consumed between groups over time, and neither group exceeded the Dietary Guidelines for Americans for this age group.[9]

Increases in weight and percentage of body fat measurements continue to be of considerable concern in the military. Soldiers are required to meet body composition standards biannually.[20] If soldiers are unable to meet these standards Commanders can refer the individual to a weight management program (e.g. Army Body Composition Program); an inability to meet body fat standards in a designated period of time can result in discharge from military service. Therefore, continued strategies targeting appropriate reduction of fat mass and an increased lean body mass are essential for a fit-and-ready force. Of note is the recent report in Navy Times describing the plan that the U.S. Navy has to re-evaluate their baseline standards for body weight/body fat. A senior Navy official stated that roughly one-third of Navy personnel are heavier than the approved height-and-weight standards and must be taped. He continued to say that ‘the accuracy

of the charts needs to be examined because over time the size and shape of the population has changed, so it makes sense to ensure the standards are valid'.[21]

In this study there were no significant increases in BMD in the TG. Few studies have examined the impact of deployment on BMD. Sharp et al.[17] reported improvements in overall BMD as measured by dual-energy xray absorptiometry (DEXA) over a 9-month deployment to Afghanistan. Carlson et al.[22] reported mixed results with increases in spine BMD and decreases in femoral neck BMD after a 12-month deployment to Iraq. The results of the current study did show improvement in post-deployment bone health, with non-significant but positive increases in calcaneal BMD in both groups, and significantly greater mean-change in osteocalcin levels in the TG compared to the CG. To our knowledge, this is the first study to examine osteocalcin levels before and after military deployment, especially as it pertains to a telehealth intervention. Others have shown a positive relationship between physical training and osteocalcin levels.[23] Because there was a significant increase in the sport index in our TG, and the mean age of our cohort would suggest they may still be accruing bone mass, one hypothesis is that the elevated bone turnover (increased osteocalcin) represents bone-building activities. Another hypothesis is that bone trauma, such as stress fractures, reported by seven (7) soldiers in the TG post-deployment, may have been healing which could be characterized by greater bone turnover. Yet, eight (8) soldiers in the CG also reported stress fractures and both groups achieved gains in BMD over the deployment; this counters the latter hypothesis. Further studies are needed involving deployed soldiers in order to examine the environmental and physical activity impact on BMD and bone biomarkers.

No significant relationships were observed for dietary factors between groups. However, this study underscores the fact that male soldiers fail to meet the DRI for vitamin D, and even when supplemental vitamin D is consumed, soldiers meet ≤ 50 percent of the DRI. This study is in agreement with a recently published study reporting low vitamin D intake among deployed soldiers.[22] Vitamin D is necessary for normal bone growth and maintenance. Low vitamin D levels have been associated with an increased risk in musculoskeletal injuries in active duty military,[24-25] therefore more public health programs for military personnel are needed to raise awareness of the nutritional factors that influence change in bone density and stress fracture risk. A recent study showed that low-fat dairy products and the major nutrients in milk (calcium, vitamin D, and protein) were associated with greater bone gains and a lower stress fracture rate, and that potassium intake was associated with greater gains in hip and whole-body BMD.[26] In addition, a recent paper details the widespread concern by Army leaders over the unhealthy eating habits and nutritional deficiencies of Army personnel based on the 2008 Survey of Health Related Behaviors.[27] Results from this survey found only 17% of women and 14% of men consumed the USDA-recommended serving of fruits and vegetables per day. This is not unlike the general US population; fewer than 25% of Americans eat 5 or more servings of fruits and vegetables each day.[6] This does suggest that the majority of military personnel are not consuming the recommended nutrients, even for the average adult. Soldiers typically require increased dietary energy intake, especially during training, in order to maintain the high levels of physical activity. Persistent low energy intake and a diet lacking key nutrients may have a negative effect on health, injury, physical performance, and recovery from illness. Wentz et al. reported that chronic undernourishment played a role in the increased rate of stress fractures in military recruits.[28]

In summary, choices regarding lifestyle are important for all young adults but the challenges to a balanced diet and exercise regimen in the deployed environment may have long-standing

consequences for the soldier, as well as total force fitness. Health promotion efforts by Brigade-level public health nurses and dietitians during deployment and in peacetime can have a major impact on lifestyle behaviors and bone health of young soldiers who are developing peak bone mass. Early and aggressive educational outreach efforts can prevent deployment-related chronic musculoskeletal conditions as well as disabling osteoporosis later in life.

Effect of problems or obstacles on the results: Access to the internet and to our website was the greatest obstacle encountered and severely impacted our opportunity to successfully implement a telehealth coaching intervention. Access was sporadic for most participants and when available, soldiers often chose to use their internet time to write email home to loved ones. This was not an unforeseen challenge to the team at the outset; however, as the theater matured we expected improved internet access would be a high priority for soldier morale. This is the content from a study participant's email message and reflects the situation for many participants for whom this never improved: UNCLASSIFIED "We have very bad internet access here. AKO almost never works. Sorry. We're trying to get a new system set up." (Dtd Monday, December 05, 2011 9:19 PM) We also faced the challenge of Units being separated and sending soldiers to various Forward Operating Bases where some had internet access and others did not. There was a consistent group of 8-12 soldiers who accessed the internet and read study materials regularly, posing an occasional question back to the study team. One example related to how best to continue the Paleolithic diet plan while deployed. In June of 2012 we began attaching "read receipt" to the emails but this did not significantly change the likelihood of participant response. On-demand telehealth coaching occurred for the TG from August 2012- January 2013 via email and a study website. This was a shorter interval of time than projected; however, the deployment period was curtailed from 12 to 9 months with little notice.

Strengths and Limitations: The study has several strengths and limitations. By focusing on wellness during deployment, we were able to pique the interest of several Commanders who willingly volunteered their combat arms soldiers as potential participants. However, no individual of authority was present during the recruitment briefings and all soldiers volunteered without coercion or fear of reprisal. The choice to use separate groups under separate Commanders was intentional to avoid contamination of the telehealth coaching intervention. There was no guarantee that soldiers in one Brigade, even if assigned to separate Companies/Platoons/etc., would not be co-located at Forward Operating Bases or sharing the same living quarters. Also, conversation amongst soldiers deployed together may have led to sharing advice from the coach which could have altered the behaviors of others. Another strength of the study was the highly qualified, interdisciplinary research team comprised of two credentialed dietitians interacting with the soldiers frequently, a doctorally-prepared dietitian/exercise physiologist consultant, a PhD-prepared nurse team leader, and an experienced endocrinologist, all available to address any metabolic, physiologic, or study-related issue that might arise. This is one of the first studies on Joint Base Lewis-McChord to recruit soldiers in the unit garrison area and perform all study measurements onsite in the unit classroom, both before and after a deployment. We feel certain that our efforts to accommodate the units in this manner led to a more robust enrollment and overall low attrition rate.

Limitations include the low sample of females enrolled and their attrition rate of 93% in particular. This is most unfortunate as it leaves many questions unanswered regarding their

deployment health behaviors. Every effort was made to encourage all soldiers to return for follow up measurements. A postcard with a reminder to return to the data collection point within 30 days of redeployment was sent to all soldiers in each group about 60 days prior to their return. The study team was willing to accommodate even one or two soldiers who wished to return for measurements but could not make it during the scheduled follow up period. A weakness of the study is the difference in the length of the deployments; we anticipated that both units would deploy for 12 months but the TG deployment occurred during the military drawdown and the time in theater was shortened to 9 months. This allowed less time for our telehealth intervention and may have disadvantaged this group in terms of exercise and dietary behaviors. Another weakness of this study is the heavy reliance on self-report. The dietary intake and exercise data were obtained via self-report which is notoriously unreliable, particularly when involving a 9-12 month interval of time obscured by potential combat-related events and psychological stress. It also limits what conclusions may be drawn and their generalizability across all combat arms units. At least one recent paper suggests that the best method of capturing and understanding physical activity, even in basic combat training, is to use a combination of self-report, direct observation, and accelerometer-type instruments.[29] Similarly, experts recommend that dietary intake is best accomplished using interview methods for 24-hour or 3-day recall on several occasions.[30] These methods were impractical for this study.

Conclusion: We enrolled 234 soldiers in this prospective, longitudinal, cluster-randomized, controlled trial to evaluate a telehealth option for maintaining nutrition status and bone health during a 9-month deployment. We examined anthropometrics (weight, body fat, waist circumference, resting energy expenditure), dietary intake, physical activity, and bone health biomarkers to measure the impact of internet coaching between one group of soldiers receiving on-demand health information and another group who received only one-time diet and exercise education prior to deployment. While overall impact appears low, ***the TG did demonstrate significantly greater bone turnover (as measured by osteocalcin) and an increase in sport activity***, with greater numbers of soldiers also participating in a second sport activity, although this was not statistically significant. Bone mineral density and bone turnover were stable over time in both groups, suggesting that deployment may not have as negative an impact on bone health as hypothesized. However, ***the TG also experienced a 4% increase in body fat while the CG experienced a modest decline***. This may represent a shift to greater body fat mass and less lean mass from general changes to diet and exercise/physical training behaviors, although not evident in survey data. Body weight, waist circumference, and BMI were essentially unchanged for the TG, leaving no clear rationale for the increased body fat. The two major brigades involved in this study deployed to Afghanistan but at different times and most likely to different locations. The availability of gyms and the appeal of the dining facilities were very site-specific. In order to promote healthy living and morale during deployment, offering similar resources and recreational options across the deployed environments seems important. Our results are similar to those reported by Lester et al. (2010) and their recommendation was for Commanders and unit medical personnel to encourage individual fitness in the deployed environment if unit level training is not practical.[12] We strongly concur. Our telehealth approach for coaching individuals while deployed was less effective than hypothesized, as it did not reach the critical volume of participants necessary to achieve robust, measurable changes. However, this work makes an important contribution to our understanding of the dietary and physical activity behaviors of

deployed soldiers and allows us to revisit assumptions regarding optimizing Warfighter performance and health.

Significance of Study or Project Results to Military Nursing

Soldier nutritional status and bone health are critical components of operational readiness. Military life encompasses unique circumstances that increase Soldiers' vulnerability to nutrient deficiency unlike the general population. Altered nutritional status may impair physiologic and immunologic functions resulting in performance decrements and diminished resistance to illness and disease. A report from the Institute of Medicine (IOM), Mineral Requirements for Military Personnel (2006), provides data to support a relationship between adequate mineral levels and optimal physical and cognitive performance. Maintaining healthy weight and physical fitness goals while deployed may be instrumental in facilitating performance reintegration for Soldiers resuming garrison duties and routine physical fitness testing upon redeployment.

Current combat environments vary somewhat throughout the theater of operations with different morale, welfare, and recreational activities available, as well as variable dining options; this scenario is unique and different from past conflicts where greater consistency across deployment locations was the norm. With the understanding that contractor-run dining facilities provide high quality food with a variety of fruits and vegetables each day, along with an ample supply of milk and other calcium/vitamin D-containing dairy products, we expected no detrimental effect on bone health from a poor diet. However, contractor-run dining facilities means methods of cooking and food selection were often times a reflection of the local economy. The U.S. foods that are typically fortified with calcium, vitamin D, and other vitamins and minerals were not consumed in the remote deployment locations. Military rations remained similar to past conflicts but were not required as frequently. No significant changes in dietary or supplemental macro-or micronutrients were observed between groups in this study. After comparing mean calories, macronutrients (protein, carbohydrate, fat) and selected micronutrients to the Institute of Medicine's (IOM) Dietary Reference Intakes, we determined that soldiers in this study closely met recommendations for caloric intake and exceeded recommendations for macro- and micronutrients. Dietary vitamin D intakes were low for both groups throughout the study. This is a recurring theme in several recent publications and it is a message that is important to share with the scientists at the U.S. Army Research Institute for Environmental Medicine (USARIEM) lab who ensure soldiers receive optimal nutrition to support the Warfighter mission. Perhaps ensuring that some U.S. fortified foods are available in theater would be a simple way to boost calcium and vitamin D intake. Little can be done about the milk product and it must be recognized as an unappealing option with minimal health benefits in its current form.

Researchers in the Bone Health and Military Operational Medicine Program are just beginning to understand the complex influences on bone metabolism from the environment, diet, genetics, exercise, and stress. It appears that the low levels of physical activity are having the greatest negative impact on fitness, and possibly bone health. This study is unique in that telehealth technology was employed to coach deployed soldiers to sustain or improve nutritional factors and exercise in order to support bone health. More studies are warranted to examine the effectiveness of nutrition and exercise interventions among active duty service members on bone health and prevention of musculoskeletal injuries. The use of similar technologies to assess bone density is critical; this study used a portable calcaneal ultrasound device and while useful in a

highly mobile population, it makes comparison across other studied difficult since many studies incorporate DEXA. This is logistically difficult to use in a large military population with a busy training calendar when soldiers cannot be given the time away from duty to present to the hospital for the DEXA measurement.

This study underscores the fact that it is not uncommon for male soldiers to fail to meet the DRI for vitamin D. Even when supplemental vitamin D was consumed, soldiers met ≤ 50 percent of the dietary reference intake. This study is in agreement with a recently published study reporting low vitamin D intake among deployed soldiers. Low vitamin D levels have been associated with an increased risk in musculoskeletal injuries in active duty military. Given the importance of vitamin D to normal bone growth and maintenance, as well as musculoskeletal integrity, Public Health Command nurses and dietitians need to work with Units to raise awareness of the nutritional factors that influence change in bone density and stress fracture risk.

Consequences of lengthy and multiple deployments include metabolic alterations such as weight gain or loss, musculoskeletal injuries, cognitive deficits, and stress-related disorders. It is unknown how long it takes for the endocrine, musculoskeletal, and immune system to return to pre-deployment levels of functioning. More research is needed to examine long-term follow up measures of physical and psychological health. Military nurses in the role of Brigade nurse/Public Health nurse or primary care clinic nurse are positioned to reinforce principles of a healthy diet and regular exercise for strong bones during each encounter with a Soldier.

There are several studies (Sharp et al. 2008; Lester et al. 2010; Carlson et al. 2013) in the literature that report findings similar to those in this study. We are beginning to compile a library of work that depicts the typical activities of today’s Warfighters. It is important for Brigade nurses to understand the health and wellness challenges faced by soldiers and to establish educational offerings proactively. Medics, physician assistants, and Brigade nurses all have a role in educating, advising, monitoring, and treating soldiers as part of the Soldier-Centered Medical Home initiative. It is studies like this one that inform the education agenda; more attention must be paid to bone health and the diet and exercise choices that influence it. It is crucial that young soldiers who have not yet reached peak bone mass understand the importance of a diet rich in calcium and vitamin D, as well as weight bearing exercises, to build strong bones and remain a fit and healthy soldier for the duration of their military service. In addition, soldiers need to be reminded of the negative impact that tobacco use and alcohol use exerts on their growing bones.

Much more research is needed on motivation and behaviors in order to better understand choices made by soldiers that impact their health and wellness. In addition, we do not yet fully understand the genetic influences related to weight, exercise, and diet. Much more work must be done in this field so that factors that can be modified become the target of our efforts. With downsizing efforts underway in the Army, overweight and unfit Soldiers will be the first ones approached by Commanders for involuntary discharge. Whether in a combat environment or a garrison community, Soldiers need support from the leadership and the health care team to remain fit and ready.

Changes in Clinical Practice, Leadership, Management, Education, Policy, and/or Military Doctrine that Resulted from Study or Project

None to date. Results continue to be disseminated and may lead to changes in policy or military doctrine in the future.

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Summary of Dissemination

Type of Dissemination	Citation	Date and Source of Approval for Public Release
Publications	McCarthy, M.S. A prospective cluster-randomized controlled trial of telehealth coaching to promote bone health and nutrition in deployed Soldiers. Healthcare 2014 [Special Issue The Close Relationship: Health and Nutrition], 2(4), 505-515; doi:10.3390/healthcare20405052014.	Madigan PAO approval: 19 November 2014
	McCarthy, M., Ramme, S., & Cummings, S. A Review of Telehealth Applications in the Military Community. In A.L. Cobb (Ed) Military Operations, Health, and Technology. Nova Science Publishers, New York. 2011.	Madigan PAO approval: 26 April 2011
Publications in Press	Frank, L. L., & McCarthy, M.S. Telehealth Coaching: Impact on Dietary and Physical Activity Contributions to Bone Health During a Military Deployment. Military Medicine (Special Issue focusing on presentations from the Military Health Services Research Symposium). In Review.	Madigan PAO approval: 16 December 2014
Published Abstracts	McCarthy, MS, Ramme, S, and Frank, LL. Challenges of Telehealth Coaching with Deployed Soldiers. Presented at the Council for the Advancement of Nursing Science Meeting, 18-20 September 2014, Washington, D.C. Published Nursing Outlook, 63(1), Jan-Feb 2015, 102.	Madigan PAO approval: 4 November 2013
Podium Presentations	McCarthy, M., Ramme, S., & Loan, L. Telehealth Coaching to Promote Bone Health and Nutrition in Deployed Soldiers. 2014 Western Institute of Nursing Conference. Presented April 2014 in Seattle, WA.	Madigan PAO approval: 4 November 2013

	McCarthy, MS, Ramme, S, and Frank, LL. Challenges of Telehealth Coaching with Deployed Soldiers. Presented as an Abstract of Distinction at the Council for the Advancement of Nursing Science Meeting, 18-20 September 2014, Washington, D.C.	Madigan PAO approval: 4 November 2013
	McCarthy, M., Ramme, S., McGiffin, K., & Hobbs, C. Telehealth Coaching to Promote Nutrition Status and Bone Health in Deployed Soldiers. The TriService Nursing Research Program and Evidence-Based Practice Dissemination Course 2014. Presented 15-18 September 2014 in San Antonio, Texas.	Madigan PAO approval: 21 July 2014 and 4 September 2014
Poster Presentations	McCarthy, M., Ramme, S., McGiffin, K., & Loan, L. A Coaching Intervention to Promote Nutrition and Bone Health in Soldiers. AMSUS 117th Annual Meeting, Karen A. Reider Federal Nursing Poster Session. Presented 8 November 2011 in San Antonio, Texas.	Madigan AMC PAO approval: 4 Nov 2011
	McCarthy, MS, Ramme, S, McGiffin, K, and Loan, LA. A Coaching Intervention to Promote Nutrition and Bone Health in Deployed Soldiers. 17th Biennial Phyllis J. Verhonick Nursing Research Course, San Antonio, TX, April 2012. *Received award for "Outstanding Poster Representing Health Promotion through Prevention"*.	Madigan AMC PAO approval:
	McCarthy, M., Ramme, S., & Loan, L. Telehealth Coaching to Promote Nutrition and Bone Health in Deployed Soldiers. Military Health System Research Symposium, Presented 18-20 August 2014 in Ft. Lauderdale, Florida.	Madigan AMC PAO approval: 16 April 2014
	McCarthy, M., Ramme, S., McGiffin, K., & Hobbs, C. Telehealth Coaching to Promote Nutrition Status and Bone Health in Deployed Soldiers. The TriService Nursing Research Program and Evidence-Based Practice Dissemination Course 2014. Presented 15-18 September 2014 in San Antonio, Texas.	Madigan AMC PAO approval: 4 September 2014

	McCarthy, M., & Ramme, S. Challenges of Telehealth Coaching with Deployed Soldiers. Greater Bay Area: Region 1 Sigma Theta Tau Chapter & Omicron Delta Chapter International Nursing Conference. Presented 7 June 2014 in San Francisco, CA.	Madigan AMC PAO approval: 3 March 2014
	McCarthy, M., & Ramme, S. Telehealth Coaching to Promote Nutrition and Bone Health in Deployed Soldiers. 3rd International Conference on Soldiers' Physical Performance. Sponsored by USARIEM. Presented 18-20 August 2014 in Boston, MA.	Madigan AMC PAO approval: 21 July 2014
Media Reports	McCarthy, MS and McGiffin, K. Health and nutrition status during deployment. Northwest Guardian (newspaper). 23 February 2012. McCarthy, MS. The wear and tear of war: A program of research dedicated to bone health in young Warriors. Army Nurse Corps Association (ANCA) Newsletter; 36(1), March 2011.	Interview and content written by Madigan PAO 16 February 2012. Madigan PAO approval: 8 March 2011
Other	McCarthy, MS. Research Aims to Help Soldiers Stay Fit, Stay Ready…Stay Army. TSNRP News, Issue Spring /Summer 2014, p 2-3.	Madigan PAO approval: 20 February 2014

Reportable Outcomes

None

Recruitment and Retention Table

Recruitment and Retention Aspect	Number	
Subjects Projected in Grant Application	200	
Subjects Available	242	
Subjects Contacted or Reached by Approved Recruitment Method	242	
Subjects Screened	242	
Subjects Ineligible	3	
Subjects Refused	1	
Human Subjects Consented	234	
Subjects Intervention Group / Control or Sham Group	85	149
Intervention Group / Control or Sham Group Subjects Who Withdrew	21	57
Intervention Group / Control or Sham Group Subjects Who Completed Study	64	92
Intervention Group / Control or Sham Group Subjects With Complete Data	64	92
Intervention Group / Control or Sham Group Subjects With Incomplete Data	21	57

Demographic Characteristics of the Sample

Characteristic	Mean (SD) or Frequency
Age (yrs)	23.7 ± 3.1
Women, n (%)	14 (6)
Race	
White, n (%)	116 (49.6)
Black, n (%)	27 (11.5)
Native Hawaiian or other Pacific Islander, n (%)	7 (3.0)
Asian, n (%)	3 (1.3)
Missing	69 (29.5)
Ethnicity	
Hispanic or Latino, n (%)	24 (9.9)
Military Service	
Army, n (%)	234 (100)
Service Component	
Active Duty, n (%)	234 (100)
Tobacco Use	
No	44.1%
Yes	53.6%
Missing	2.3%
Alcohol Use	
No	28.0%
Yes	69.5%
Missing	2.3%
Stress Fracture History	
No	88.4%
Yes	11.6%
Family History Bone Disorder	
No	91.9%
Yes	8.1%

APPENDIX A

Your Nutrition Report

ID NO

Your average intake		*Your* Recommended levels
Calories	7370.61 Kcal	Depends on your age, sex, body size and physical activity
Fat	313.40 g	25-35% of total calories
as % of cals	38.27%	
Saturated fat	106.72 g	Less than 7% of calories
as % of cals	13.03%	
Monounsaturated fat	117.15 g	
Polyunsaturated fat	60.46 g	
Protein	317.60 g	10-20% of total calories. For you
as % of cals	17.24%	184.00 - 369.00 grams per day
Carbohydrate	838.69 g	50-60% of total calories (primarily from whole grains, vegetables and fruits)
as % of cals	45.52%	
Cholesterol	1085.33 mg	Less than 200 milligrams
Dietary Fiber	49.79 g	20-35 grams or more
Alcohol % of cals	0.00%	1 drink/day or less
Sweets % of cals	25.15%	Use sparingly. Full of empty calories

Antioxidants from diet		
Vitamin A	1925.35 RAE	RDA for you: 900.00 RAE
Beta-carotene	9775.37 mcg	5000-6000 micrograms from food
Vitamin C	380.66 mg	A good diet can provide 200-400 milligrams
Vitamin E	19.90 mg	RDA: 15.00 mg.
B-Vitamins from diet		
B1, B2	6.11 mg	RDA: 1.20 milligrams
Niacin	79.46 mg	RDA: 16.00 milligrams
Folate	1285.06 mcg	RDA: 400.00 micrograms
Vitamin B6	6.34 mg	RDA: 1.30 milligrams
Minerals from diet		
Calcium	2186.55 mg	RDA: 1000.00 milligrams
Zinc	41.18 mg	RDA: 11.00 milligrams
Iron	45.53 mg	RDA: 15 milligrams
Potassium	8952.69 mg	3000 milligrams or more
Sodium (salt)	12230.54 mg	2400 milligrams or less
Magnesium	861.61 mg	400.00 milligrams or more

Your Food Group Servings		USDA My Pyramid Recommendations
Bread, pasta, rice	18.85 1 oz. equiv.	10.00 oz. -equiv per day
Whole grains	2.39 1 oz. equiv.	5.00 oz. -equiv per day
Vegetables group	3.95 cups	4.00 cups per day
without potatoes	2.76 cups	2.80 cups per day
Fruits, fruit juices	4.03 cups	2.50 cups per day
Milk, cheese, yogurt	2.93 cups	3.00 cups per day
Meat, eggs, or beans	33.75 1 oz. equiv.	7.00 oz. -equiv per day
Good oils, in foods	3.44 "teaspoons"	11.00 "teaspoons" per day

Where the nutrients are coming from in *your* diet

Calories
- Ice cream
- Kool aid
- Breakfast egg sandwich

Total Fat
- Breakfast egg sandwich
- Ice cream
- Ribs

Saturated Fat
- Ice cream
- Breakfast egg sandwich
- Cheese

Cholesterol
- Breakfast egg sandwich
- Ice cream
- Beef

Sodium
- Other soup
- Breakfast egg sandwich
- Pork

Fiber
- Soy milk
- French Fries
- Breakfast bars

Vitamin C
- Kool aid
- Real orange juice
- Hi C

Potassium
- Soy milk
- French Fries
- Other soup

Vitamins from supplements

Vitamin A	0.00 RAE
Vitamin C	0.00 mg
Vitamin E	0.00 mg a-toc
Folate	0.00 mcg
Calcium	0.00 mg
Iron	0.00 mg
Zinc	0.00 mg

Suggestions about your diet:

For better health, lower your saturated fat intake to less than 7% of total calories.
To achieve this goal, eat more vegetables, fruits and grains, and fewer fatty foods. Look at your top three sources of saturated fat. Try eating these less often or switching to smaller portions or low-fat types.

Congratulations! You are getting a good amount of calcium.
Keep eating those low-fat dairy products and low-fat milk, and perhaps try calcium-fortified juice. It is needed for strong bones, and for regulating blood pressure, transmitting nerve impulses, and in blood clotting. Calcium supplements are also valuable, to ensure that you are getting enough.

Congratulations! You are eating your vegetables and fruits!
They can lower the risk of cancer and heart disease. And of course, they are usually low in fat. Experts recommend eating at least five servings, of a combination of fruits and vegetables, every day. Salads count as do vegetable soups and stews. A big bowl of salad, or a big plate of stew with lots of vegetables, might count as two or even three servings.

My Pyramid Food Groups
Learn how your diet compares to USDA My Pyramid recommendations for your calorie level. Half of all your grain servings (breads, pasta, rice) should be whole grains. Since 2006 USDA gives fruit and vegetable advice as "cups" of food. Beneficial oils are from natural (unhydrogenated) vegetable oils and some foods, like avocados, nuts, seeds, and fish. My Pyramid has a website, http://www.mypyramid.gov.

Body Mass Index (BMI)

Your self-reported height is 6 feet 08 inches.
Your self-reported weight is 176 pounds.
Your Body Mass Index (BMI) is 19.33.

Body Mass Index (BMI) is one of many factors that may be related to developing a chronic disease such as heart disease, cancer, or diabetes.

BMI	Weight Status
Below 18.5	Underweight
18.5 to 24.9	Normal
25.0 to 29.9	Overweight
30.0 and above	Obese

If your BMI is above 25, or if you are Asian or South Asian and your BMI is above 23, you might want to talk to your health care provider about weight loss strategies. For overweight people, even a small weight loss may help to lower the risk of disease.

APPENDIX B

Figure 1. CONSORT diagram showing the flow of participants through each stage of the randomized trial: A Coaching Intervention to Promote Nutrition and Bone Health in Deployed Soldiers